

## TITLE

A Study of the Association Between Cancer Rates and TCE Ground Water Contamination in Communities Surrounding Hill Air Force Base, Utah from 1973–2001

## THEME

Advance Environmental Public Health Science and Research

## KEYWORDS

cluster analysis, spatial analysis, Geographic Information Systems, cancer

## BACKGROUND

Twelve contaminated ground water plumes in a shallow aquifer emanating from Hill Air Force Base (AFB), Utah has caused concerns of adverse health risk in the surrounding communities. The primary contaminate of concern is trichloroethylene, which has been recognized as a potential carcinogen.

## OBJECTIVE(S)

The Utah Environmental Public Health Tracking Program (UEPHTP) initiated this project to improve the methodology used to link and analyze exposure and adverse health outcome data. A major component of this project will be the future incorporation of the Bayesian methodology provided by the Rapid Inquire Facility (RIF).

## METHOD(S)

Cancer records for Davis and Weber Counties were obtained from the Utah Cancer Registry and geocoded. Those cancers with a study area consisting of 143 census-block groups within 7.5 miles of the center of Hill AFB were included in this study. Residential tenure and familial history of cancer information obtained from the Utah Population Database were linked to the cancer case records. Population data for the study area was obtained from the 1970, 1980, 1990 and 2000 census. The graphic boundary of the plumes was obtained from Hill AFB. The population of any census tracts within 400 meters of any graphic TCE plume boundary was considered to be exposed. Standardized rates were adjusted for sex, age, residential tenure and familial history of cancer. Analysis for cancer clusters in space and time was conducted using the SatScan statistical software. Analysis of exposure risk was conducted using the odds ratio. Data was provided to the Imperial College London, and future analysis will implement their Rapid Inquiry Facility.

The RIF is a menu-driven software tool designed at the Small Area Health Statistics Unit (SAHSU), Imperial College London, to enable fast and easy computations of relative risks in relation to environmental pollution sources, using routinely collected data on health outcomes, such as cancer incidence and mortality. The RIF is currently undergoing redevelopment to use ArcView (ver. 9 using Visual Basic for Applications) and to enable it to use U.S. data. The locations of contaminated ground water plumes can be incorporated and rates and relative risks calculated for the predicted exposed population. The highest resolution for which data is to be used for the RIF study of Hill AFB is the census-block group level.

## RESULT(S)

Geocodable addresses were obtained for 24,433 (98.7%) of all primary cancers diagnosed in Davis and Weber Counties from 1973 to 2001. From these cancers, 11,113 were in the study area. Pre-cancer addresses were available for 4,556 (41%) of the cancer cases and relatives were found for 2,249 (20.2%) of the cases. Relatives of cases with cancer were identified.

Fifteen multi-census-block group clusters of cancers by anatomic site were identified. Cancer types included oral, esophageal, colon, rectal, pancreatic, lung, other respiratory, breast, prostate, testicular, other urinary, brain and lymphoid leukemia. Future analysis incorporating Bayesian methods will be conducted using the RIF analytical tool.

## DISCUSSION/RECOMMENDATION(S)

Traditional cluster analysis methodologies are limited in their capacity to find clusters of rare events. This project's objective is to improve the capability of cluster analysis by developing data linkage tools and implementing the Rapid Inquiry Facility. Spatial linkages will be made between cancer registry data, residential history and familial cancer history data, Utah census population and socio-economic data, and limited environmental exposure data. Additional work is being done to link Bayesian based analytical methods.

Preliminary analysis of multivariate adjusted counts was done using the SatScan statistical software. This software is freely available and easy to use. Tools were developed to extract spatially referenced data in the ArcView GIS software and format it for use by SatScan.

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